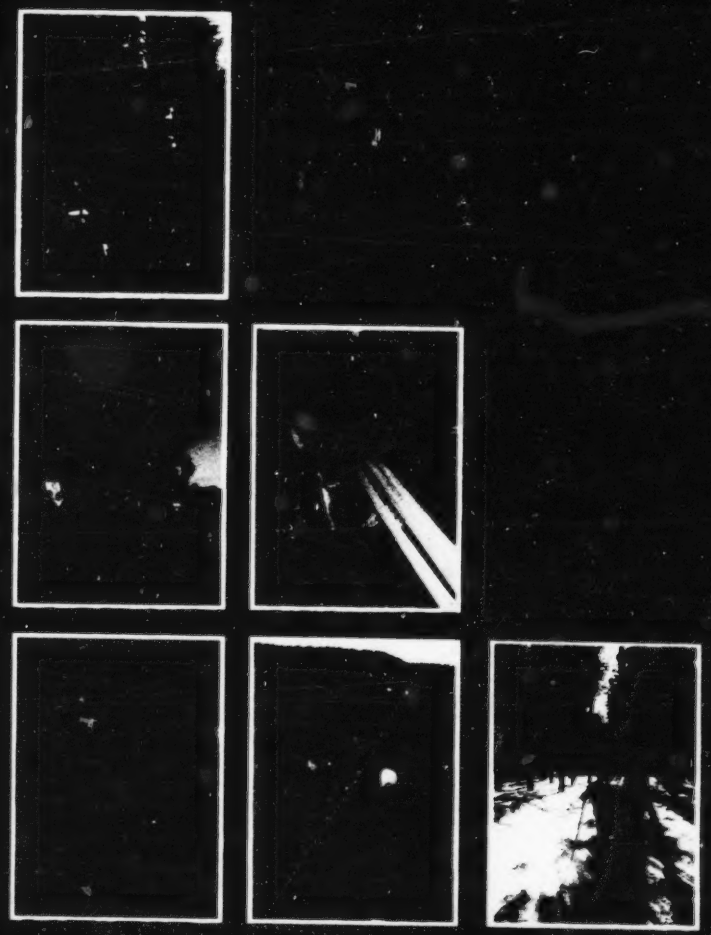
Forest Fire Management in Ontario



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Ontario
Ministry of Natural Resources
Aviation and Fire Management Centre

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Introduction

More than 85 per cent of Ontario's land area is covered by forests – a traditional resource and one which is a key to our future.

Forests, like commercial gardens, must be tended and managed if they are to meet the growing demands placed upon them by an industry serving enlarging markets. Carefully planned forest management programs implemented by the Ontario Ministry of Natural Resources, in concert with private industry and the public, are complemented by equally well-planned fire management strategies, policies and programs.

Fire has traditionally played the role of destroyer, and it will always have that capability in our forests. But fire management is showing us that fire can be beneficial under strictly measured guidelines and controlled circumstances, and when part of an integrated land and resource management program.

The annual volume of wood harvested on Crown-owned lands in Ontario, over 20-million cubic metres, generates over $60 million in direct revenue to the Crown in the form of stumpage, bonus charges and area charges payable by those companies that cut the trees.

Ontario's wood harvest, forest products processing and regeneration activities provide jobs for approximately 75,000 people directly and an equal number indirectly. About 9,000 are employed in harvesting and over 66,000 in wood products and pulp and paper manufacturing. In northwestern Ontario, 79 per cent of all manufacturing jobs are in the forest sector. In southern Ontario, the comparable figure is six per cent but many more jobs are indirectly supported by the forest industry.

The average annual total value of shipments of forest industry products in Ontario is $8.5 billion. Forest are valuable in ways that are harder to measure. They are the foundation of a tourism and recreation industry, which is a major income generator and a varied source of enjoyment for Ontarians and visitors alike.

In 1878, the Province of Ontario enacted its first forest fire prevention legislation. By 1897, 191 rangers were serving on Crown lands throughout the province.

Natural Role of Fire

Fire has always been a significant and natural phenomenon in Ontario's forests. Several factors influence fire, including prevailing climate, weather and tree species. Climatic conditions have limited the tree species capable of growing in the province, and weather conditions throughout any given year are the dominant factor that often determines the level of fire danger in the forests. Dry conditions make the forests especially prone to fires started by lightning strikes and the carelessness of people. Conifer trees are very susceptible to fire. Deciduous trees do not readily burn and large enough stands can act as a natural barrier to an advancing fire. Fire is so prevalent in the natural forest ecosystem, that many tree species are uniquely adapted to regenerating after fire.

The Boreal Forest environment is a fire-dependent ecosystem. In the absence of fire, nutrient cycles may be impeded by incomplete decomposition of forest litter and humus. The burning of the forest litter and humus results in nutrients being put back into the ground and clears the way for new growth. On the other hand, this material is a fuel for fire and accumulations make lightning fires and high-intensity burns increasingly probable. Frequent fires prevent the succession of forests to the species. Instead, a mix of successional stages, communities and age classes of trees is maintained by periodic fire.

Fire by itself is neither friend nor foe and becomes good or bad only as it relates to human value systems. The historical presence of fire has created a healthy forest mosaic of uneven age and diverse species that has become an essential renewable resource.

A conflict arises when fire, fulfilling its natural role, interferes with human plans to settle in the forest and utilize its resources, whether through industry or recreation.

Unwanted fires must be suppressed to protect human life, private property and natural resources; to prevent social disruption; and to ensure a minimal effect on public works.

The opportunity to benefit from fire exists with prescribed burning, which allows for seed-bed preparation, development of wildlife habitat, control of insects and disease, vegetation management in wilderness areas and conversion of a forest area from one tree species to another.

The forest fire management organization of the Ontario Ministry of Natural Resources has the mandate to minimize the ill effects and maximize the benefits of fire, relative to the interests of people and nature.

Curtiss HS-2L flying boat used for reconnaisance during the 1920s.

History

Throughout history, lightning-caused fires burned unchecked until halted by natural barriers, lack of fuel or change in weather.

Great fires were recorded by Jesuit missionaries in the 1600's. Alexander Mackenzie noted huge fires burning north of Lake Superior in the 1780's. Massive fires were also mentioned in the diaries of early Hudson's Bay Company employees.

Forest fires posed little problem to early nomadic tribes. The Indian people used fire to clear land for crops, encourage growth of berry plant species and to herd wild animals.

Early European settlers used logs to build, and then burned the cutover area to remove stumps, slash and undergrowth in preparation for farming. Logging companies began to use fire to remove slash, as it reduced the cost of moving the cut trees to the roadside.

Junction and Cochrane. The estimated death toll was 73. In 1916 the most deadly fire in Canadian history erupted in the Matheson area, burning the

Above: The great Haileybury, Ontario fire of 1922 which destroyed much of the townsite.

Below: Fire ranger poling up the Abitibi or Mattagami River in 1922.

Disastrous results were often the outcome of fires set to clear the land. Few controls on burning existed and the people had little knowledge of fire behavior.

This century was marked by a number of tragic fires accidentally started by settlers clearing forest land for agricultural use. In 1910, on the Ontario-Minnesota border, a forest fire erupted in the Beaudette/Rainy River area. It killed 42 people and burned 125,000 hectares. The next year, the infamous Porcupine fire, one of the largest in Ontario history, engulfed over 200,000 hectares, including Timmins, South Porcupine, Porquis Junction and Iroquois Falls and taking 244 lives.

The Haileybury fire in 1922 killed 43 and destroyed 6,000 homes as it raged across the equivalent of 18 townships. The Fort Frances fire of 1938 killed 17 and burned over 40,000 hectares.

Since the early days, Ontario's firefighting methods have vastly improved but there are no grounds for complacency. Severe fire conditions still often force the evacuation of residents, and occasionally entire communities from the path of forest fires.

Development of Legislation

Government became concerned with forest fires at a very early date. In 1849, the Ontario government formed a Royal Commission to seek ways to protect the forests from unnecessary destruction.

In 1878, the province enacted its first forest fire prevention legislation, setting up fire districts and regulating the use of burning during hazardous periods. In 1885, the first forest fire rangers were appointed and posted to timber operations, with the provincial government and the timber operators sharing the cost. The protection system continued to grow and by 1897, 191 fire rangers were serving on Crown lands.

These pioneer fire rangers were paid $2 a day to travel on foot, by canoe or railway handcar through their areas, warning residents and forest workers of the fire dangers, while patrolling for fires. They tried to pinpoint fires from high ground and fought them using the tools of the day – shovel, axe and water bucket. Their individual patrols often lasted as long as two to three months. Many fires were spotted and extinguished but the fire fighting system was still in its infancy and most fires burned undetected and unchecked.

Spurred into action by the Matheson disaster, the Ontario government passed The Forest Fires Prevention Act in 1917. This legislation marked the birth of a modern fire control system.

Development of Fire Protection

Permanent fire managers were hired and a field organization was developed. A system of fire detection was established, with lookout towers erected at key points on high ground. Ranger stations and supply warehouses were built across the northern areas of the province.

Mechanized equipment was introduced with the purchase of newly developed portable pumps. In 1924, the government established the Ontario Provincial Air Service, comprised of 20 World War I surplus flying boats. These aircraft were used to detect fires and carry fire crews and equipment to the scene.

The use of aerial water bombing was first tested in Ontario in 1944. Only limited success was achieved until 1957, when aircraft were equipped with water tanks mounted on the top of the floats. Float planes now carry water inside the floats, a much more efficient and effective concept. Water is scooped directly into the hulls of large amphibious aircraft. Helicopters dump water from collapsible buckets slung beneath the machine on a cable.

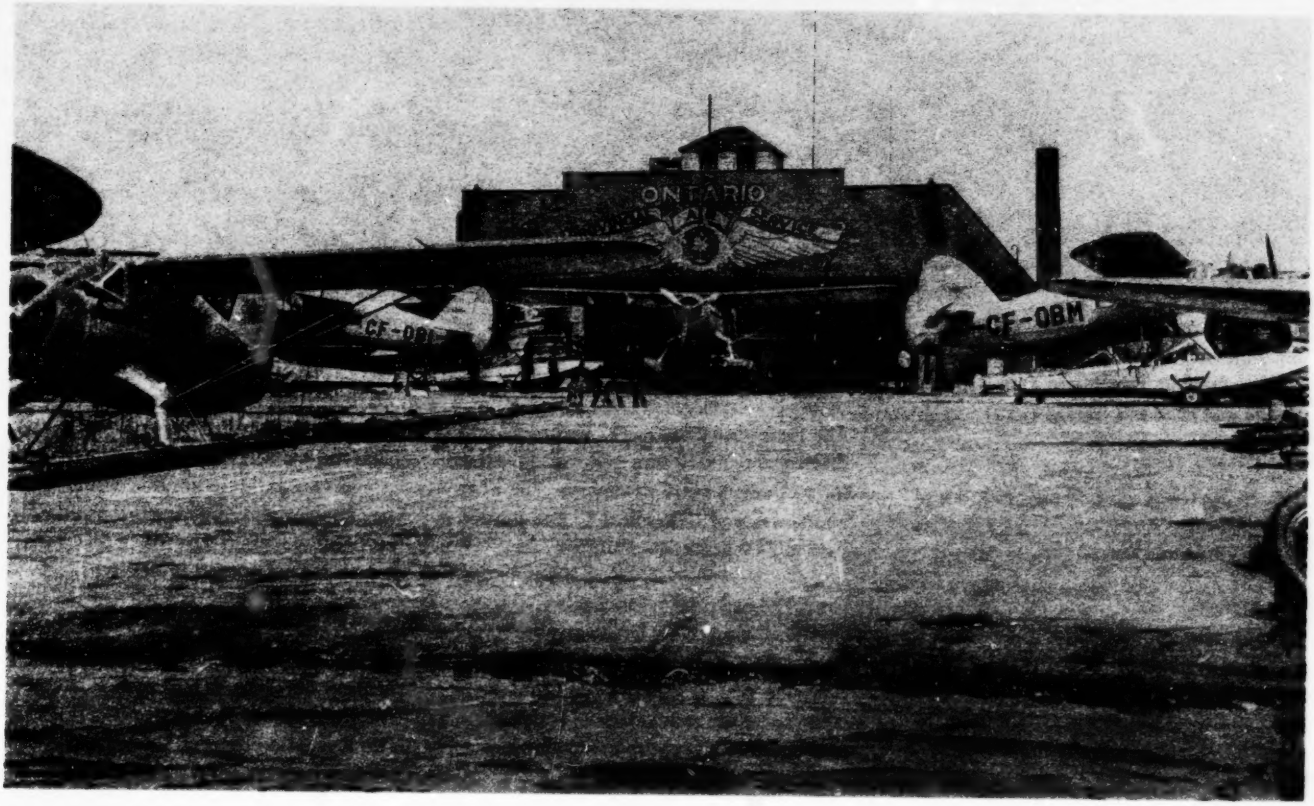
Current Reorganization

The 1970s and the early 1980s have been a time of major change for the fire management organization. In 1973, the province was divided into eight regions broken down into 49 districts, and a two-level, field fire organization was established. In 1983, command and control for forest fire management was centralized at the regional level, resulting in one fire organization in each region, a more efficient way to detect and attack forest fires.

The provincial fire centre, the Aviation and Fire Management Centre, located at Sault Ste. Marie, provides year-round centralized fire control for the province and coordinates the movement of personnel and equipment from region to region during the fire season.

Above: Wooden lookout tower near Ruel constructed from site materials, 1917.

Below: Provincial Air Service hangar at Sault Ste. Marie during the 1940s.

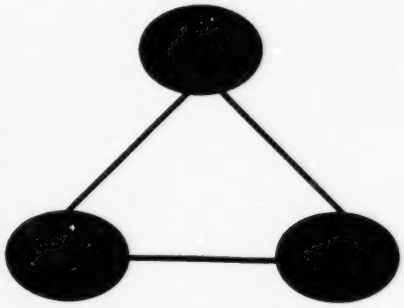


The Nature of Fire

An understanding of fire behavior is essential to effective fire fighting.

Fire is a chemical reaction in which fuel, oxygen and heat, the three elements of the fire triangle, combine to form the process called combustion. Since fuel and air always exist in the forest, the presence of heat or fire is the decisive factor and introduces the element of risk.

The moisture content of forest fuels is a primary factory governing fire ignition. If moisture is present in the fuel, more heat is required to bring the fuel to the ignition temperature.



Fuel size and arrangement also affect the ease of ignition. Fine fuels have more surface area by volume exposed to the air than do coarse fuels. Moisture evaporates faster and combustion becomes possible sooner. Loosely spaced fuels are more exposed to the air and burn faster than tightly packed fuels.

If pieces of fuel are arranged far apart, fire will spread slowly and the drying effect of heat on unburned fuels will have less impact. Vertical arrangement of fuels is also important. Fire can flare up to the tree-tops if there is a continuous ladder of fuel.

The density of the forest also affects fire spread. A high volume of burning fuel will produce greater heat and more rapid heating of surrounding fuels. Spread rates differ for different types of trees. Hardwood stands usually form fire barriers because they burn slowly. Pine and other conifers, which are high in oil and resin content, usually pose no obstacle to fire. Healthy, living trees resist fire better than dry, diseased stands.

Weather has a critical and complex influence on forest fires. Wind, for example, affects the drying rate of the forest and the supply of oxygen to the fire. Wind may carry sparks or embers ahead of the fire, starting new fires. It may bend the convection column of a blaze toward the ground, heating fuels ahead of the fire.

When relative humidity is low, the air can absorb moisture readily, promoting evaporation and rapid drying of the forest fuels. On humid days, moisture content of the air is near the saturation point and fuels will retain more moisture and be less susceptible to ignition.

The most important weather factor is precipitation. A long, dry spell will drastically reduce moisture in a forest, making it dangerously flammable. Drought conditions also lower the water table or level of underground water. When rain falls following a long, dry period, it quickly seeps deep underground, leaving the surface and sub-surface fuel layers dry once again.

Weather conditions, and therefore, fire conditions vary with the time of day. During daylight hours, relative humidity tends to be lower, temperatures higher and winds stronger, resulting in more rapid drying of fuels. For this reason, fires often burn slower and less intensely in the evening or in the early morning than at mid-day.

A final factor that must be considered is topography. Fire tends to burn more quickly up a slope, as the slant brings the convection column closer to the surface. The flame front itself may also come in contact with upslope fuels. The direction a slope faces also affects fire behavior. Fuels on slopes facing the sun dry out faster and burn more intensely than fuels on slopes facing away from the sun.

Types of Forest Fires

The various combinations of fuel type and condition, weather and topography produce three different types of fires: sub-surface, surface and crown fires.

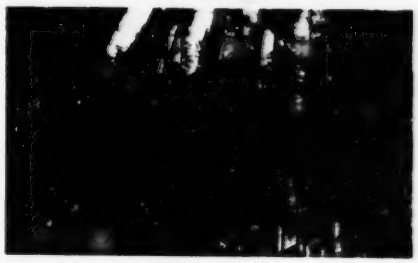
Sub-surface fires burn beneath the surface of the forest floor. This type of fire can smoulder for extended periods of time, burning peat, roots and decaying vegetation before breaking through to the surface, often far from the source of the fire.

Surface fires are the most common type of forest fire. They burn brush, leaves or grasses and forest debris. When burning on a forest floor, they can damage the bark of trees and often lead to torching of the entire tree.

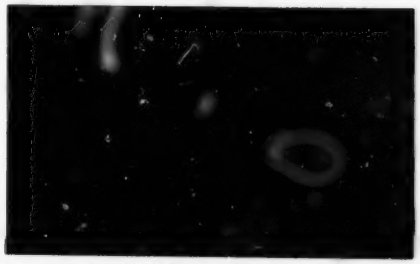
The flame of a crown fire is the most dangerous and destructive. The fire can easily spread from the crown or top of one tree to another, often moving faster than a person can run. High winds can result in the canopy of the forest being set ablaze over a large area, while the forest floor remains relatively untouched. This is the most spectacular type of fire and the most difficult to manage.

A forest fire can include all three types of burning during its life span.

Sub-Surface Fire.



Surface Fire.



Crown Fire.

Effects of Forest Fires

Fire brings about changes in plant species in a variety of ways. Fire may trigger the release of seeds from jackpine cones. It also stimulates the flowering and fruiting of many plants. Fire alters seed-beds by removing litter and humus and baring the mineral soil. Removal of the overstory by fire will stimulate reproduction of many herbs and woody plants. It also acts to temporarily reduce competition for moisture, nutrients, heat and light – favouring whatever species have the means of reproduction readily available. Ash from burned over areas enriches the soil and assists new growth.

The frequency of forest fires determines the successful stage that plant communities can be expected to reach.

The impact of fire on landscape is apparent in the predominance of those species which regenerate readily after fires, such as jackpine, black spruce, aspen and white birch.

A fire ecology study completed in Quetico Park suggests that the average period before a forest fire re-occurs in an area previously burned over in northwestern Ontario, given no fire suppression efforts, is approximately 78 years.

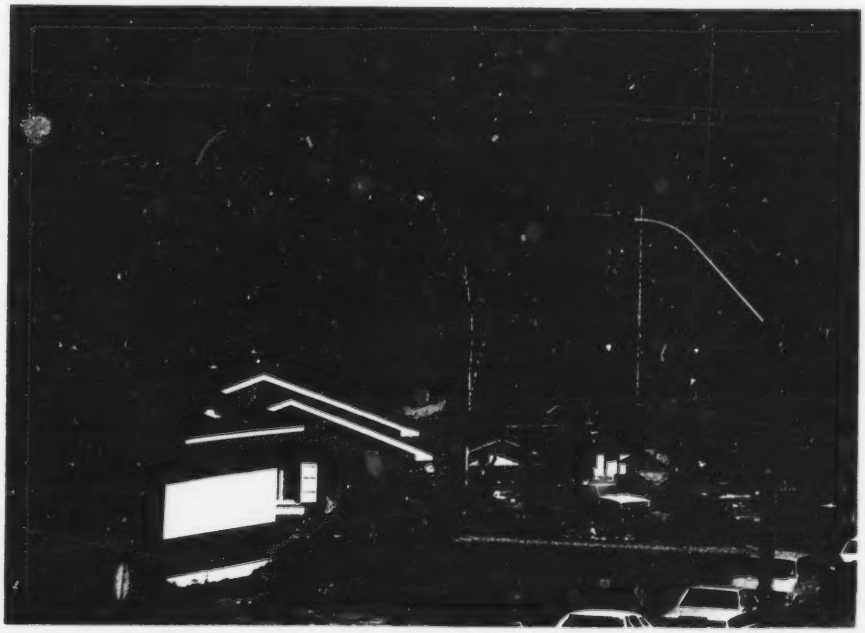
Fire also works to affect wildlife habitat patterns and populations. It increases the food supply for moose, deer, beaver and hare, which depend largely on forage that proliferates within accessible heights immediately following a fire. By contrast, fire eliminates forage plants found in old forests, notably the tree and ground lichens consumed by woodland caribou.

Different animal species are adapted to different stages of forest succession and fire regimes. Fire increases the yield of many berry-producing plants to the benefit of bears and many birds. Game birds such as ruffled grouse benefit from openings created in bush areas. Fire regulates many insect populations, some of which are important food sources for warblers, woodpeckers and other birds.

Overall, the impact of forest fire is to control the relative abundance and location of plant communities. These determine animal habitat patterns, regulating both population and distribution.

When people are dependent on forest resources, fire is very costly to a wide range of forest users.

Fire can wipe out thousands of hectares of valuable timber, threaten lives and communities, cause social disruption and cause heavy private and commercial property losses. During the decade 1973-83, an average of 2,150 fires occurred each year in Ontario during the fire season, April 1 to October 31.



Destruction of timber values means that logging companies have to look farther afield and incur greater costs to eventually get their product to market. A fire can spell ruin for the local operator, who is without ready access to alternate wood supplies.

Other losses defy calculation. For example, interruptions in transportation due to railway or highway closings, harm to tourist businesses by destruction of scenery and tourist facilities, economic disruption caused by evacuation of threatened communities, and the loss of homes and cottages in forest areas represent a dollar figure that is incalculable.

Large fires may produce subtle ecological effects by altering the relationship of organisms to their environment. When a fire removes plant cover, greatly accelerated run-off of rainfall can result, causing erosion problems. Water quality may be affected as water supplies become polluted by suspended silt, ash and other eroded materials.

Removal of this forest cover can cause marked increases in water temperature. This can have a detrimental effect on fish habitat.

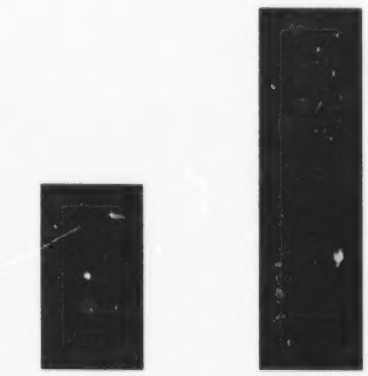
The effect of fire on animals is harder to judge – it can be both harmful and beneficial. The immediate impact may be harsh. Animals that have escaped a fire are forced to seek food and shelter elsewhere, their natural food supplies and habitat having been destroyed.

In addition to the commercial, recreational and ecological impacts, forest fires also result in major fire fighting expenditures every year. The province is now committing approximately $35 million annually to forest fire control. The government also loses stumpage revenue from the destroyed timber stands and incurs the cost of regenerating the burned over areas.

Fire Causes

Lightning is the only natural cause of fire and is responsible for 30 per cent of all forest fires. People are responsible for the remainder. Records of fires caused by people establish the responsible groups and sources of ignition. This information allows managers to direct fire prevention efforts to the cause of the problems.

The careless smoker is responsible for more forest fires than any other forest user. Nearly one-quarter of all fires caused by people are ignited through the careless use of smoking materials.



*1980-85, 6-year annual average

Carelessly attended campfires rank just behind smoking materials, igniting approximately 19 per cent of all people-caused fires. While the number of campers and outdoor enthusiasts using the forests has increased, the number of blazes caused by this group has actually dropped, but not significantly.

Residents burning grass, brush or rubbish trigger about 13 per cent. About 13 per cent of fires in recent years have been railway related, caused by exhaust carbon, work crews or pieces of hot metal from brakeshoes.

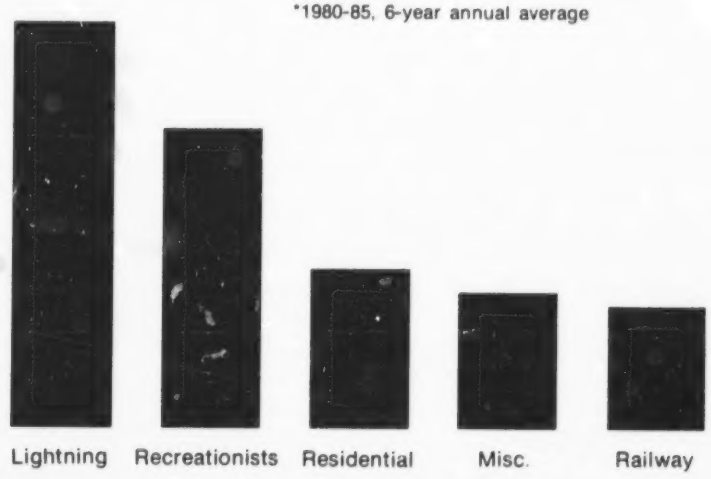
In addition, many forest fires can be traced to children playing with matches.

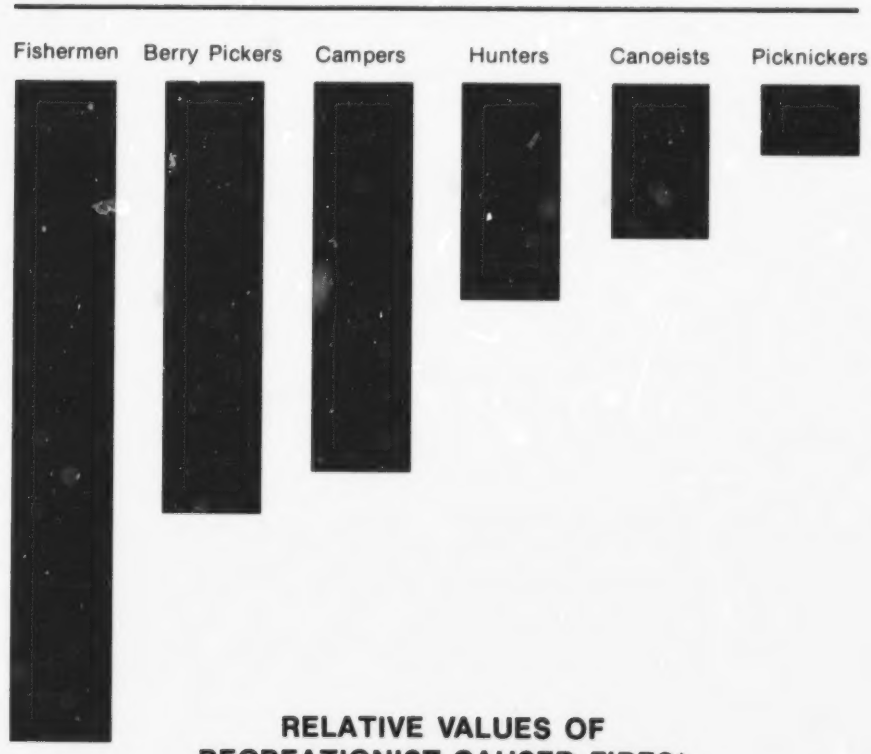
In theory then, the majority of forest fires, since they are started by people, can be prevented.

Who Causes Fires?

RELATIVE VALUES OF FOREST FIRES FROM ALL CAUSES*

*1980-85, 6-year annual average





RELATIVE VALUES OF RECREATIONIST-CAUSED FIRES*

*1980-85, 6-year annual average

NOTE: For the period 1980-85, inclusive, a total of 9202 fires were caused by all sources. Of this total, 6147 were man-caused and 3055 lightning-caused. Among man-caused fires, recreationists using Ontario's woodlands were the largest single source, accounting for 1923 fires during the period specified. The annual average number of fires from all sources was 1533.

Aviation and Fire Management Centre

The Aviation and Fire Management organization of the Ministry of Natural Resources, with central headquarters in Sault Ste. Marie, pursues many courses of action against forest fires: prevention, presuppression, fire occurrence prediction, detection and initial and sustained attack on a fire.

The centre at Sault Ste. Marie sets standards, audits field operations and tests and evaluates new equipment and products. It co-ordinates resources: manpower, equipment and aircraft; provides fire weather information gathered from all regional centres and acts as a central communications outlet. The centre also produces and supervises training programs, and maintains co-operative relations with other provincial, national and international fire agencies.

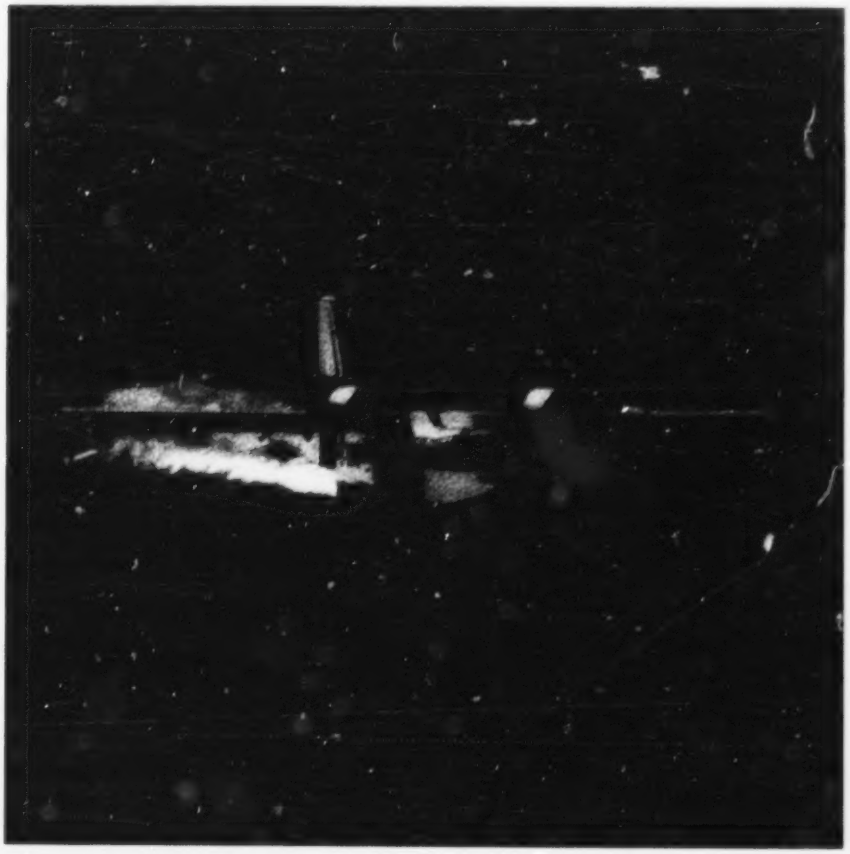
Fire Management and Policy

Over the years, fire management objectives in Ontario had developed into a policy of total suppression – an attempt to suppress all fires in Ontario forests at all costs. This policy proved both impractical and uneconomical.

Foresters now realize that fire, like sunlight and rainfall, is an important and natural part of the ecological cycle. It plays an important part in the natural regeneration of a forest. But before any forest area is allowed to burn, a number of variables must be considered.

In 1980, the Ministry of Natural Resources Fire Management Improvement Project (FMIP) began. The purpose was to develop and implement an improved fire management system for Ontario.

The new policy outlined the basic principles, definitions, roles, relationships, responsibilities and overall objectives of the ministry's fire management activities. In addition, the policy stated three objectives for the ministry fire management program: to prevent loss of human life, to prevent personal injury and to minimize social disruption; to ensure that fires have a minimal effect on public works, private property and natural resources; and to use the natural benefits of fire to achieve ministry objectives for land and resource management. This was the beginning of the integration of management plans for fire control and lands and resources.



Integrated Resource Management

Forest fire management is an integral part of land and resource management. As of 1982, the new fire policy provides that every fire will receive a response that is governed by the values at risk and the cost of the response.

The whole resource management program is designed within a comprehensive planning system and is implemented in accordance with area plans. The area plan outlines fire management objectives for a given land base or fire management zone and contains further plans that describe the administrative procedures and operating guides necessary to accomplish the fire management objectives. In this process, fire managers set their priorities for both fire control and fire use in their areas. This provides the overall guidance to protect Ontario's high value forest lands.

This policy is the framework for the integration of fire management with the rest of the ministry's resource management programs. It requires consultation with resource managers with respect to values at risk and the type of fire response that should be provided should wildfire occur. It demands effective communications with municipalities and the forest industries. This policy is intended to be more proactive and less reactive.

In an ongoing effort to reach the goals set out, further research is required to assist in determining fire's ecological role in the forests of Ontario. Better systems are being developed to determine the impact of resource management plans

and activities on fire management objectives. Better methods are required to determine values at risk in a given area before fires occur. Similar methods are required to determine the economic impact of forest fires on all resource related activities.

Forest fire researchers are contributing to the integration of fire management activities with those of land and resources, through integration of resource related research. Fire economics research is undertaken as part of forest economics studies. Fire ecology studies are being combined with forest ecology studies, and fire meteorology studies are undertaken as a component of forest meteorology research.

FIRE REGIONS OF ONTARIO

Prevention

A fire prevention program has three components, often referred to as the three E's: Education, Enforcement and Engineering.

Of the three, public education is the most visible. Advertising and public relations are used to create a public awareness of the dangers and causes of forest fires. Through the media, the schools, public gatherings and the use of printed materials, films and videotapes, Smokey Bear and road signs, the ministry is putting forth a concerted effort to educate and warn the general public and industry about people-caused fire problems.

Ministry information officers channel information to the media about current forest fires and fire hazard situations, explain the cause and effect of fire, and spread the fire prevention message. Special fire prevention campaigns are co-ordinated and directed toward forest user groups.

Enforcement is based on The Forest Fires Prevention Act. This legislation applies to the Ontario fire region, a described geographical area that excludes the largely urban or agricultural south and the extreme north.

The Act and regulations spell out safety precautions and measures governing the use of fire in forests, and establish penalties to deter violators and careless users.

The Act defines a period in each year to be recognized as the fire season (April 1 to October 31). During these months the fire danger is the greatest and fire prevention legislation applies. A fire permit must be obtained before shooting off fireworks or before starting any fire outdoors during the fire season, except for cooking and warmth. Fire permits allow fire managers to keep track of the number and type of fires burning in a given area at any given time.

Smoking while walking or working in a forest during the fire season is prohibited. Likewise, it is forbidden to throw or drop smoking materials, live coals or ashes.

By law, a campfire may only be started in a location with a one metre area around the fire edge cleared to the bare rock or mineral soil. If you start a fire, the Act states that it must be tended by a responsible person at all times, and must be extinguished completely before you leave the site.

The Act provides the Minister of Natural Resources with the authority to impose and enforce special restrictions during periods of extreme hazard. The Minister may declare a ban on open fires or may close access to portions of the forest.

These restrictions are applied to eliminate people-caused fires and to reduce the risk of forest fires.

Controls also apply to commercial operations. Regardless of the time of year or fire danger, a work permit is required to carry on logging, mining or industrial operations in the forest and within 300 metres of a forest. Permits are also required to clear land, operate a lumber mill or perform any operation producing slash or debris. Any permit will be suspended or cancelled if fire conditions become hazardous or if the terms of the permit are not met.

One of the tasks of firefighters is to determine the cause of the blaze. This is usually not difficult, since the fire burns out or away from the source. Fewer than five per cent of fires are classified as unknown in origin. Once the point of ignition is located and the cause determined – often careless use of smoking materials or camp-fires – a routine investigation usually finds the person responsible.

Aviation and Fire Management Centre

Engineering refers to the protection of values by the removal or reduction of fire hazards. For example, homes or forest areas should be protected with fire-breaks to retard the progress of fires which might occur. Other aspects of engineering provide access routes for fire crews, especially constructed campfire sites in provincial parks to prevent outbreak of fire, and the spark arrestors required on industrial equipment.

Fire itself is an engineering tool used to remove potential hazards, such as dry, flammable grasses and brush that grow along railway rights of way, and which can erupt into flames as a result of sparks from locomotive brake shoes or embers discharged from diesel locomotives. It is better to burn these areas under controlled conditions than to have to respond to a forest fire.

Presuppression

Success in Ontario's forest fire management program depends heavily on measures taken and programs implemented long before fire breaks out. Considerable planning, analysis and evaluation at all levels of the fire organization, and ongoing training for fire crews and fire supervisory personnel ensure than manpower and resources are ready and prepared for any fire when required.

The basic objective of presuppression is to be prepared for any fire occurrence, anticipated or otherwise; to reduce the time span between the start of a fire, its discovery and eventual control.

Attack Planning

Detailed planning is essential. It is carried out at the Sault centre and the five regional fire centres, with the Sault office co-ordinating the entire planning effort.

In addition to advance planning in the major centres of forest fire management, detailed planning is a necessity at the field office level. In order to implement a quick and appropriate reaction to the outbreak of fire, the field office staff must know the location and condition of roads in a given area, forest fuel types and values, which lakes are suitable for landing float and amphibious aircraft, and what smaller water sources are available for helicopter and fire crews with portable pumps.

This overall prescription for any fire management area also details high-hazard and fire-prone areas, and lists the types of trees by species and condition, commercial value timber and other high values in the area. Armed with such detail, the field officer in charge is able to respond effectively to a fire by assessing the seriousness of the situation, dispatching the number of crews required and determining any needed backup.

Fire Personnel

The basic fire fighting unit is the five-person fire crew, comprised of a crew leader and four firefighters. Presuppression plans include the preparation of organization charts showing the chain of command in the event of large or multiple fires. Normally, 170 fire crews are available throughout the province. In addition, six fire teams, comprised of fire specialists, are on short-term alert for duty anywhere in Ontario.

Training

Fire fighting demands intensive training in order to ensure safety and effectiveness. Training activities are co-ordinated by provincial and regional training officers, and reach all levels of the fire management organization. At the beginning of each fire season, the fire crews across the province receive instruction in fire behavior, safety, suppression techniques, and maintenance and operation of tools and equipment. These sessions last from five to 10 days depending upon the experience of the crews.

Fire bosses and other supervisory personnel attend training courses on current developments in all aspects of fire management. Sessions are also conducted in the administrative aspects of fire fighting, such as accounting. Senior personnel are taught how to handle multiple fires. Pilots receive training in air attack, organization and airspace control. Air attack bosses learn methods of co-ordinating the water bombing aircraft.

Equipment

Equipment used by firefighters ranges from the simple to the sophisticated. Nobody has found substitutes for hand tools such as the shovel, axe or the pulaski, which is a combination axe and grub hoe used to dig small trenches or uncover burning material in the ground. A vital part of presuppression is ensuring that enough of these tools are available and in top condition. Bulldozers and other heavy equipment are obtained as required.

Other basics such as gasoline-powered, portable pumps and hose to bring water from nearby water sources to the scene of the fire, and back-pack water pumps are used in line-holing and mop up actions.

Getting fire fighting personnel to the scene of a fire is an obvious priority. The ministry owns trucks and small boats, but in most cases, ministry aircraft are used to transport personnel and equipment to fires and to serve as waterbombers.

Additional aircraft from the private sector are contracted to supplement the operations of the provincial air fleet, by providing detection and bird dog service and meeting general transport requirements. Helicopters are used for initial fire attack (helitack), as well as for regular fire service and support operations. The helicopters are more versatile and are used in varying capacities throughout the year. They are not hindered by periods of freeze-up and spring breakup of the waterways.

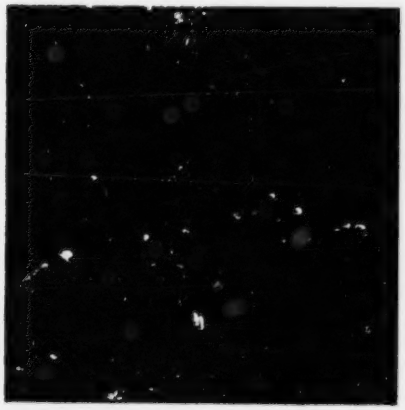
A major fire fighting effort requires massive logistical support for crews and supervisory personnel in terms of food, lodgings and base camp equipment. The ministry has thousands of sleeping bags, cots and tents, as well as pre-fabricated kitchens that can be moved into remote areas.

While some traditional pieces of equipment are still proving very effective, current technology is being employed as well. Hand-held heat sensors can locate hot spots where fire is smouldering underground and impossible to see. As well as hot spotting, larger units mounted in helicopters or fixed wing aircraft are used to map the exact perimeter of the fire through dense smoke.

Forest Industry Involvement

Since 1981, the Ontario Ministry of Natural Resources and the Ontario Forest Industries Association have worked closely to integrate the industry into the overall fire management program.

Two fire training programs were developed in 1981 and expanded in 1983. One program trains forest industry supervisors to serve as fire bosses during the early stages of a fire. The other program trains forest industry workers as fire crew members. They will work on fire crews, under their own supervisors when required. Each company conducts its own fire training courses. Since early detection and suppression efforts are so important in containing a fire while it is still small, these private industry fire crews provide an extremely important service.



Realizing the value of prevention, the industry makes a concerted effort to educate its employees regarding fire prevention measures. Employees who work in the forests are made more aware of the potential fire dangers and the careless practices that too often result in devastating fires.

The Ontario Forestry Association has formed a fire prevention committee. An advisory member from the Aviation and Fire Management Centre sits on the committee.

Communications

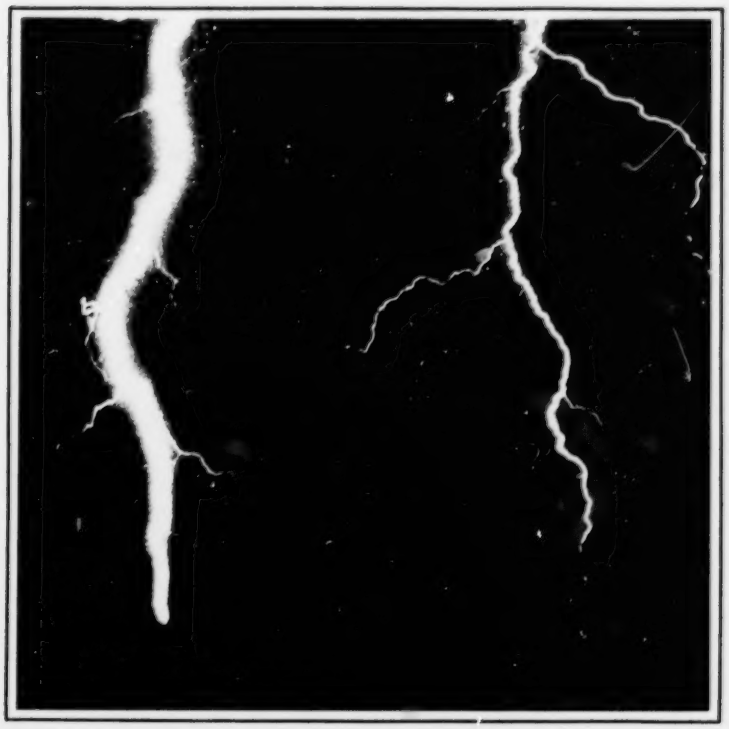
The radio communications network is maintained to a high standard of efficiency at all times. An efficient radio system greatly reduces the time lag between the detection of a fire and the process of bringing it under control.

The major line of communications on a fire and between the fire and an attack base or a regional fire centre is maintained by using VHF/FM radios.

Fire line personnel use hand-held portables to communicate with one another and to contact the fire base camp. Fire base camps use a high powered transmitter/receiver to maintain contact with attack bases and the fire centre. Such direct communications are crucial to effective fire suppression action. Aircraft employed on the line for transportation and water bombing are equipped with similar radios for communication with ground operations.

Telex, telephone, telecopier and computer communications fill the communications gap between fire operations headquarters, regional fire centres and the provincial fire centre at Sault Ste. Marie.

The Aviation and Fire Management organization is participating with the federal government in experiments using a communications satellite. Satellite technology may eventually play a major role in the exchange of radio communications between fire bases and headquarters, or in the collection of data from remote weather stations.



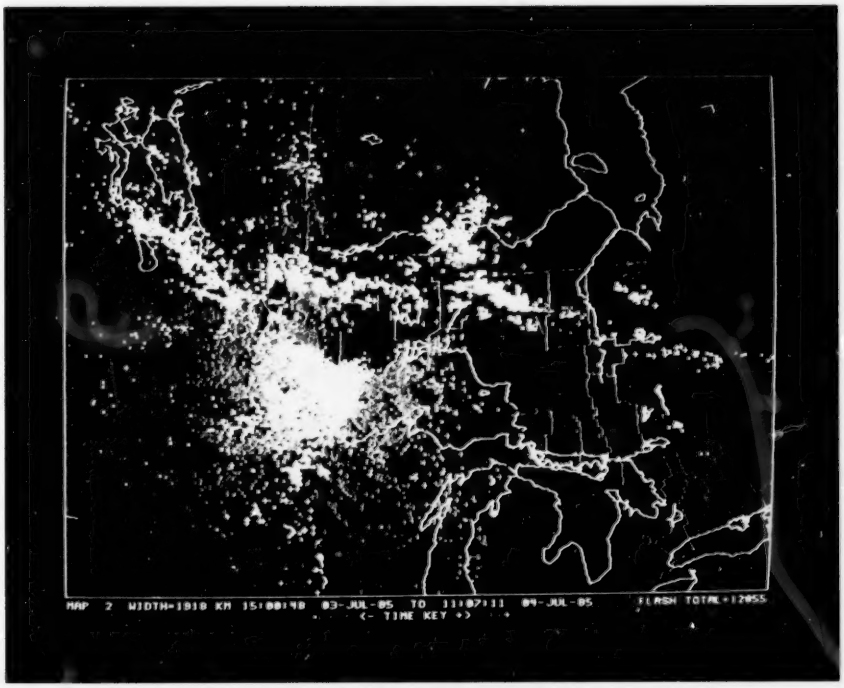
Aviation and Fire Management Centre

Monitoring Fire Weather

Weather is the most important variable in determining burning conditions in any forest area. The ministry has an extensive fire weather system that provides fire managers with the most up-to-date weather observations and forcast data. Natural Resources owns and operates 150 weather stations that are strategically located across Ontario. It also has three automatic recording stations and 70 manual portable stations for monitoring on-site weather on prescribed burn sites or wildfire locations.

The ministry operates a sophisticated lightning detection network, which maps cloud to ground lightning strike locations as they occur. The network consists of 12 direction finder stations positioned across Northern Ontario. They are linked via datalines to a network position analyzer station and the Provincial Fire Centre in Sault Ste. Marie. The position analyzer calculates strike locations and redistributes location data throughout the network. Regional fire centres in Dryden, Thunder Bay, Timmins, Sudbury and Huntsville receive the data and display the storms on monitors. All centres can usually monitor lightning strikes and pinpoint locations within one minute after lightning has occurred.

Fire managers rely heavily on weather forecast data from Environment Canada - Atmospheric Environment Service (AES). AES provides specialized fire weather forecasts twice daily to fire management centres throughout the province. It also provides special forecasts on request for use on prescribed burns or wildfire locations. In addition, the ministry employs five meteorologist technicians to provide weather briefing services and maintain ministry-owned weather equipment.



Fire weather data in the form of weather observations, forecasts or lightning data are transmitted to all fire management centres daily. This information is vital for fire managers in assessing fire danger, short and long term weather conditions, and how they might influence forest fuels, ignition, and current fires.

Determining Fire Danger

Fire managers use a danger rating system for determining potential fire behavior for any given management area. The system used in Ontario – the Canadian Forest Fire Danger Rating System – is used in all provinces. Developed by the Canadian Forestry Service, Fire Danger Rating Research Group, it is comprised of (a) Forest Fire Weather Index System (FWI), and (b) Fire Behavior Prediction System.

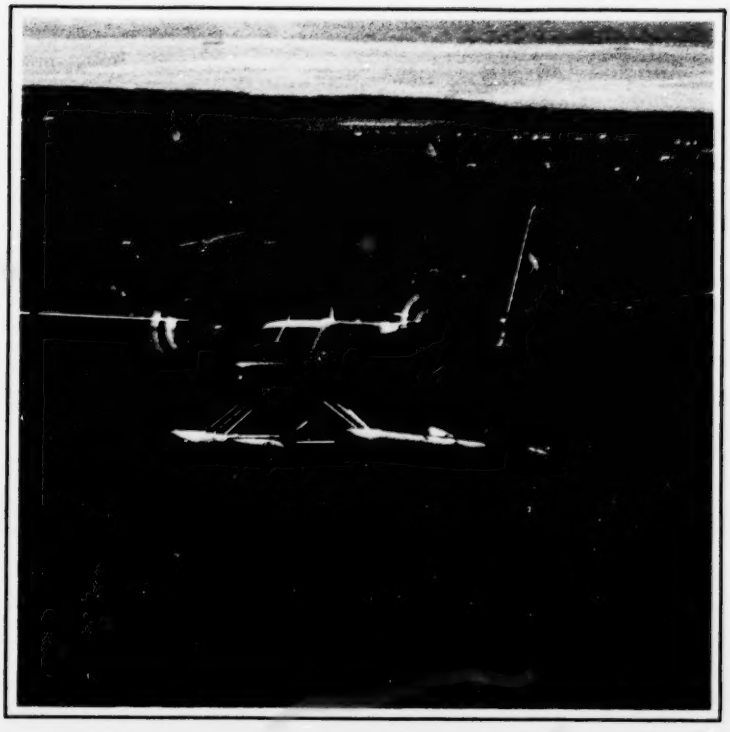
The Forest Fire Weather Index System provides a numerical rating on daily changes to fuel moisture, and provides daily indices on potential fire spread, fuel consumption, and fire intensity. The ratings are based on weather measurements of temperature, relative humidity, windspeed and precipitation.

These daily indices assist fire managers in predicting ignition potential, fire growth, and the severity of the fire.

The FWI is commonly used to convey fire danger to the public. In a period of low fire danger, fires spread slowly and are easily controlled. In moderate fire danger (FWI 4 to 10) fires burn briskly and tend to spread rapidly as they increase in size. High fire danger (FWI 11 to 22) means that fires spread rapidly and may crown or spread from tree-top to tree-top.

Extreme fire danger (FWI 23 and over) implies explosive conditions. Fires start easily from sparks, burn fiercely, and will likely crown with smaller fires starting ahead of the main fire (spotting), as a result of embers carried on convection currents. Fire restrictions may be in effect during this time, and travel restrictions may be ordered if the dangerously high indices persist.

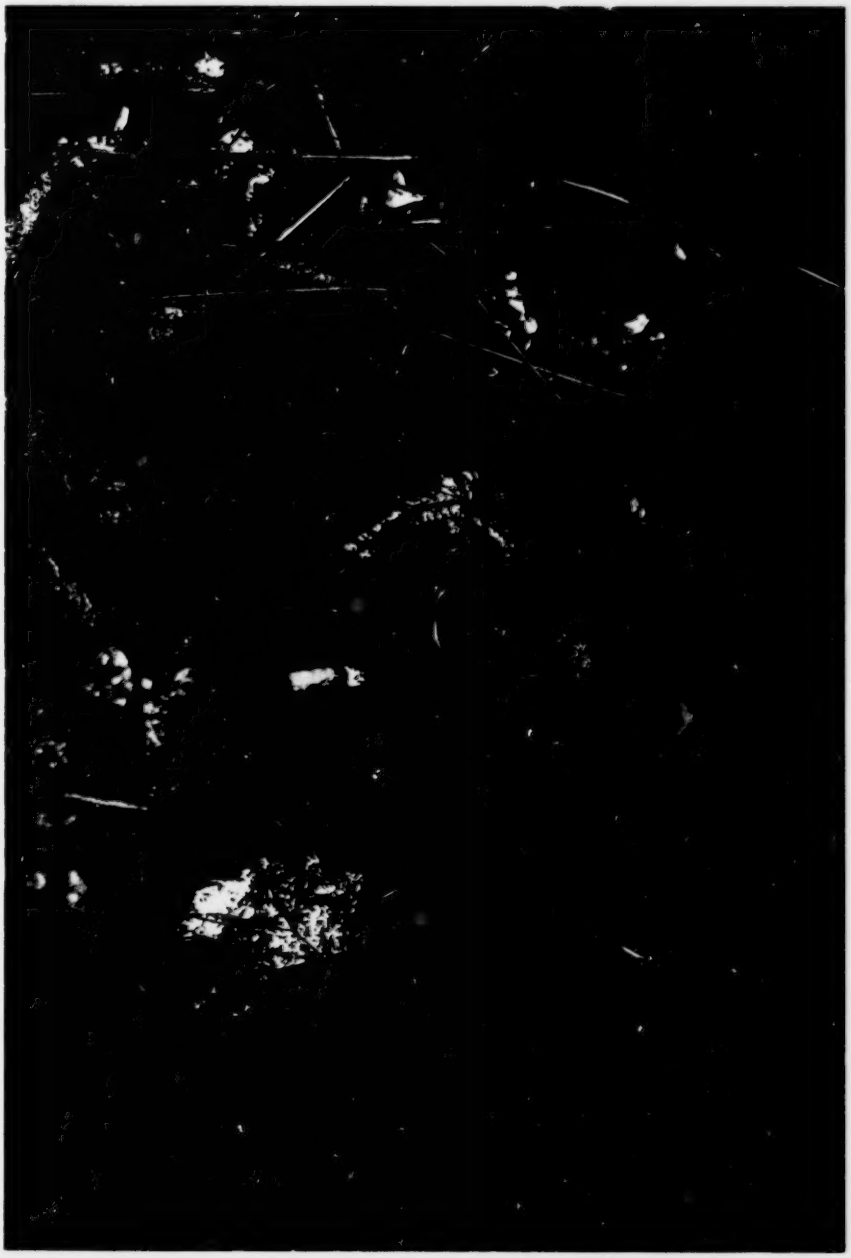
The second component of the Danger Rating System is the Canadian Forest Fire Prediction System. Fire managers combine indices from the Fire Weather Index component with known rates of spread, fuel consumption and fire intensity in standard fuel types. With this combined data they can plot fire growth over specific periods of time, predict depth of burning, and the actual fire intensity levels to be encountered. This type of information is very valuable to fire managers in developing fire suppression tactics and stategy.



Aviation and Fire Management Centre

Each attack base calculates indices and predicted fire behavior each day of the fire season for that management area. Regional centres also calculate regional summaries of indices and fire behavior.

This data is used in preparing for fire ignition, detection, aircraft employment, and initial attack crew positioning and readiness. It is also used extensively for large fires in delivering suppression efforts.



Fire Occurrence Prediction

The potential for fire is derived from a combination of elements including weather, fuels and ignition sources. Particular areas are mapped by fuel type: this combines forest species, burned area. cut-over, flooded area and areas of blowdown (trees toppled by high winds). Storms that produce lightning are predicted through weather forecasting, while lightning strikes are monitored through the lightning locator system.

Ministry personnel patrol areas where the risk of people-caused fires is high, such as settled areas, highways and railway corridors, areas with cabins and tourist camps, woods operations, access points and popular recreational waterways, but there are functions related to fire detection.

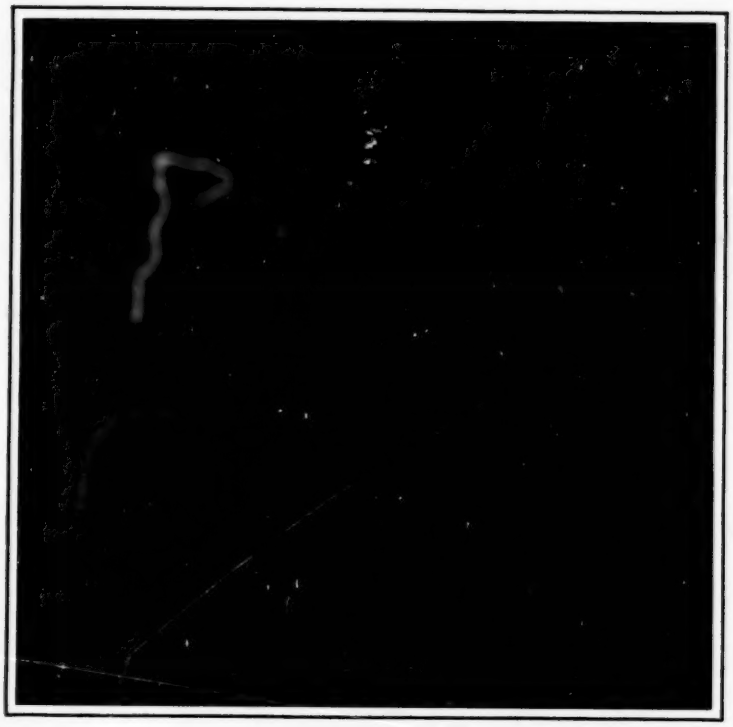
The risk of forest fires in any given area is analyzed daily to estimate manpower and equipment requirements. As the risk of fire increases, more fire fighting resources are placed on alert. Work permits enable fire staff to locate forest industry workers and equipment in forested areas that can be called out to support fire suppression efforts.

Fire Detection

Early fire detection was carried out by Rangers on foot patrol, in canoes and on railway hand cars. Common practice was to locate a tree on high ground that would serve as a fire lookout. This led to the construction of wooden lookout towers, which were first erected in 1917. In 1922, aircraft were assigned specifically to the detection and control of forest fires, and the Ontario Provincial Air Service was established in 1924 in Sault Ste. Marie. Metal towers began to replace wood in 1922, and between 1967 and 1970, aerial surveillance had completely replaced the fire tower network.

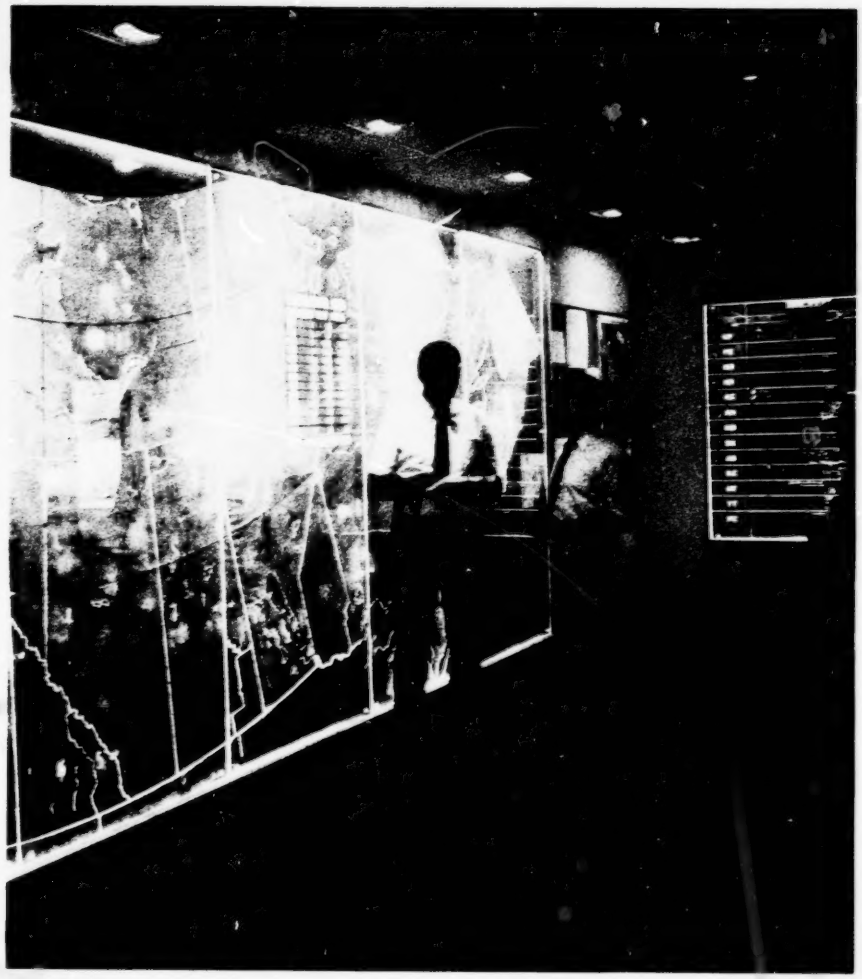
Present fire detection efforts of the ministry are directed from regional fire centres and are primarily dependent on aircraft. On the basis of weather reports and educated predictions, a forecast is made on the probability of people-caused fires and lightning fires occurring in a specified area. Aerial reconnaisance is scheduled over those areas where the probability of fire is the highest.

Supplementing the ministry's fire detection activities are the fire occurrence reports turned in by the general public and industry, and by private and commercial aircraft. A VHF monitoring frequency 122.9 MHz is located at fire operations headquarters to facilitate commercial aircraft reporting fires directly to the centre. Ministry offices have toll-free telephone numbers which can be used to report fires.



Forest Fire Suppression

Initial Attack



When a fire is reported, the officer on duty will consider the vital data - exact location of the blaze, spread potential, wind speed and direction, access routes, and proximity to water sources. Once the data has been combined with the presuppression prescription for that area, initial attack forces are dispatched from the nearest attack base. The size of the initial attack force may range from one three-person helitack crew, to an all out attack, utilizing both ground and air forces.

During the multiple fire occurrences, campaign fires or a combination of both, the fire manager must make decisions regarding which fires require priority suppression and the number of crews and other resources to assign to each fire. During peak fire load periods, some fires may not be assigned all or any resources available in that area. These decisions are made after careful consideration of all values at risk and on a priority basis they include possible loss of human life; personal injury; threat to any community that may lie in the path of a fire; public works; private property; natural resources; and the use of fire to achieve the ministry's objectives for land resource management.

Regardless of whether or not a fire is assigned any suppression resources, all fires are kept under close observation, no matter where they are burning in the province. All values to be protected must be weighed against the probability of successful action. Strategy may range from total fire suppression, to protecting specific values only. Every fire in Ontario receives a response based on the priority values at risk.

When necessary, additional resources are requested from the regional fire centre. When large or multiple fires occur in one area, manpower and equipment will be moved in from other regions. If these fire fighting resources are already committed to fire suppression, the provincial fire centre can request assistance from other provinces through the Canadian Interagency Forest Fire Centre in Winnipeg, or from the United States, under the Canada/U.S. Reciprocal Forest Fire Fighting Arrangement.

A constant evaluation is made of fires burning and the manpower and resources required to suppress them.

Each day the fire operations manager reports on new and ongoing fires, their cause, size, location and stage of control, fire crews and equipment resources available; and he outlines anticipated problems and additional requirements. All information from the field and from fire operations headquarters is forwarded to the regional fire centre to give the fire duty officer a complete and updated status report of fire occurrence in the region. This facilitates the decision making for fire crew and resource movement within that region.

This information is summarized and telexed to the provincial fire centre. At the centre, one room is dominated by a large scale map of Ontario. This, and other fire management maps at the regional centres use a common grid system that allows the accurate pinpointing of forest fire locations. During the peak fire season, it is not uncommon to have 150 fires of varied size burning across the province.

Suppression Techniques

How do you stop fire? A fire can be stopped by breaking the fire triangle through the removal of one or more of its components, heat, air or fuel. With water, mineral soil or fire retardant as the suppressing agent, fire can be extinguished by cooling the fuel below the point of ignition, smothering or robbing the fire of air, or removing the supply of available fuel by making it unburnable through the application of a retardant.

When fire crews reach the scene of a fire, power pumps are set up at nearby water sources and hose lines laid out to the fire. Depending on fire size and intensity, it can be extinguished by direct attack, where action is taken at the burning edge of the fire with hand tools and or water supplied by power pumps.

If the fire is too hot to approach or is moving quickly, the other method of suppression is indirect attack. This is accomplished by constructing a fire line away from but in the path of a fire, using hand tools and heavy equipment. The fuel in front of the approaching fire can then be removed by burning out from the fire line toward the fire.

A burn out fire must be lit with extreme caution. Fire crews wait for the right weather and wind conditions, usually in the late afternoon when winds have died down but the forest is still dry enough to ensure a clean burn. The burn out fire is ignited along the inside edge of the fire using a hand-held drip torch. The drip torch drops small quantities of a burning liquid fuel on to forest fuels.

Where large areas are involved and where fast response is vital, aerial ignition may be required. In this case, ignition dispensing devices are mounted on helicopters. These eject incendiary agents resembling Ping-Pong balls, which contain chemicals that burst into flames in a delayed action following ejection. The fire boss decides the method of attack, based primarily on the values threatened by the fire.

Various control methods can be applied to any fire. One side or flank might be attacked directly, while another side is controlled by burning out. Fire crews often lay out fire lines to take advantage of existing or natural barriers such as roads, lakes, rivers, swamps, rock outcrops or stands of hardwood timber.

A sub-surface fire requires special measures such as the digging of a trench around the smouldering area to ensure it cannot spread. Wetting agents can also be added to the water to reduce its surface tension so it will have greater ground penetration.

No two fires are the same. The one common denominator is the hard work required of skilled firefighters, often under adverse conditions.

When every spark is extinguished and the last wisp of smoke disappears, a fire can safely be termed OUT.

Air Attack

Over the years air attack has been developed into a key component of forest fire control. Most used in today's provincial air fleet are the ministry owned Otters, Twin Otters, Turbo Beavers, CL-215s and helicopters. Turbo Beavers are used primarily as general transport. The ministry also contracts to use Canso water bombers and helicopters from the private sector.

In 1983, the ministry purchased two Canadair CL-215s, the state of the art water bomber. Under federal/provincial agreements the federal government will provide the provinces and territories with addtional CL-215s. These aircraft will be a national water bombing fleet to be called out as required during times of national fire or other emergency. The federal government will own the water bombers and the individual provincial and territorial agencies will operate them. Ontario is scheduled to receive five federal CL-215s by 1987. Ontario currently has four CL-215s, two that it owns and two provided by the federal government.

Water bombers make an initial attack in an effort to contain a blaze until such time as ground crews can reach the scene and effect control. They may continue the assault on hot spots or difficult parts of the blaze, drawing water from nearby lakes or rivers. The bombers pick up water through metal intake probes on the pontoons, or in the case of the CL-215, on the bottom of the hull, while skimming over the surface of the water. Maximum water capacity is 1,000 litres for the Otter, 2,000 litres for the Twin Otter, and 5,455 litres for the CL-215. The CL-215 tanks fill in 10 seconds, requiring less than a mile to do so. This aircraft can remain airborne for four hours before refuelling. Water from all water bombers is dropped on a fire from low altitudes and the drop requires precise handling of the aircraft.

Each pilot controls the timing of the water drop but in the case of a number of aircraft being employed on the same fire, the air operation is controlled by an air attack boss flying in a bird dog aircraft.

Fire Organization

While a single crew can handle most fires, a major blaze may require 50 crews or more supplemented by air support. The crew leader of the initial attack crew becomes the first fire boss at the scene.

On large fires, a more complicated chain of command is required to ensure proper supervision and a coherent fire fighting effort. On a major fire, the fire organization has five levels of supervisory control. The fire boss remains in overall command, receiving reports directly from a suppression boss, who manages the fire fighting effort. Bosses for divisions, sectors and crews complete the structure.

The base of operations at a large fire can take on the look of a small, mobile community requiring basic social services such as the provision of food, lodging and first aid, in addition to providing transportation and communications. Co-ordinating all of this requires considerable administrative and accounting support. On a small fire, the fire boss may assume those responsibilities or delegate the task. On a large fire, the appointment of the service boss relieves the fire boss of the burden.

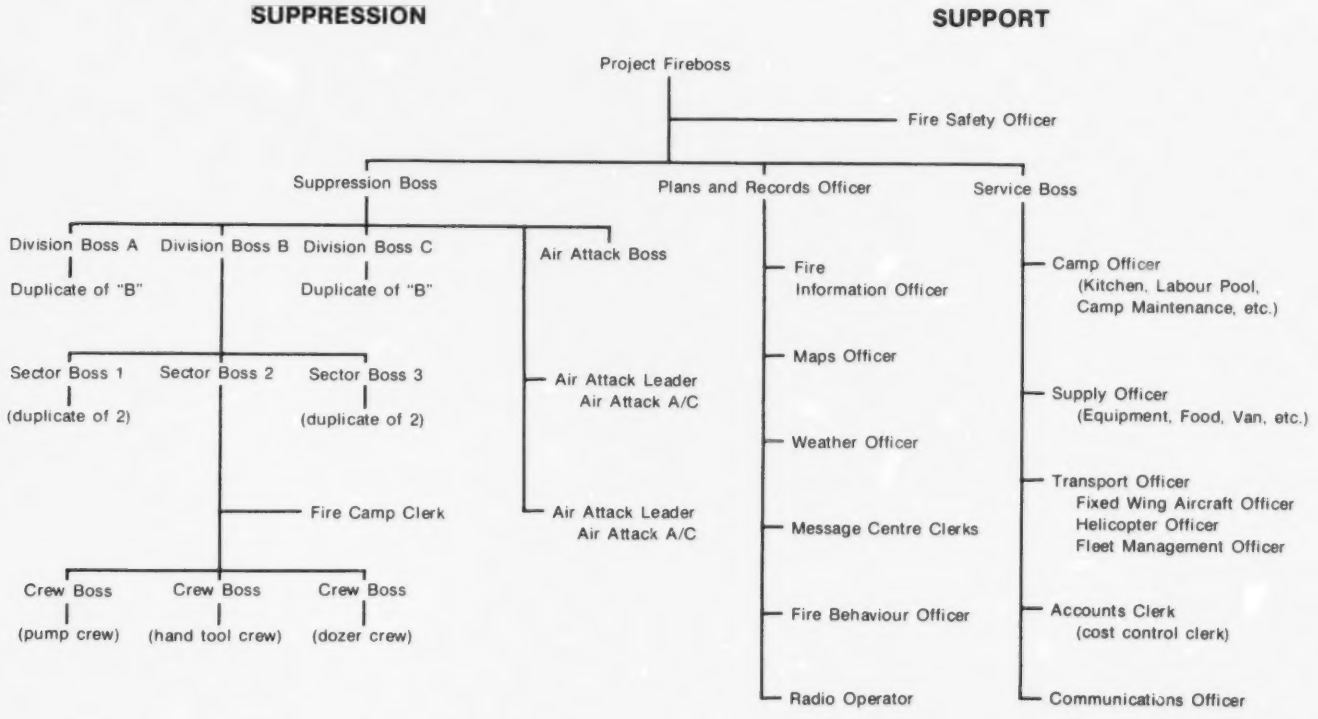
A plans and records officer compiles data daily, which the fire boss needs to make suppression plans. The data includes current and projected weather information, personnel records and updated fire maps.

Stages of Control

Not under control indicates that although the fire may be manned, its spread is unchecked.

Being held is the first stage of control, which may be indicated once crews have established lines around the fire. Once under control, fire crews can patrol with infra-red sensors picking up hot spots within the fire perimeter. These hot spots have to be individually extinguished using hand tools and back pumps to prevent a flare-up once crews leave the scene. This mopping up can take weeks following a large fire and is one of the dirtiest jobs for a fire crew.

LARGE FIRE ORGANIZATION



NOTE: The number of divisions on a fire, and accordingly the number of sectors, and fire crews employed, is determined by the size of the fire, in accordance with other factors, and is largely at the discretion of the Fire Boss.

Preparations for a Prescribed Burn

The prescribed burn is an approved and beneficial forest management technique applied by the Ministry of Natural Resources.

The decision to apply a prescribed burn

to a specific area is not made lightly. A burn is not commenced until all approvals have been obtained, following a detailed application to a district review group.

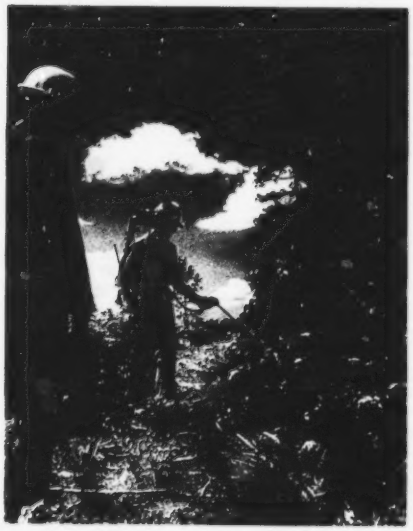
Comprehensive prescribed burn plans must be submitted which detail numerous specific elements of any prescribed burn situation. Accordingly, a prescribed burn team must be appointed, comprised of individuals with expertise in all components of the burn operation. These individuals undergo thorough briefings as a group that give them an intimate knowledge of the burn plan and the burn site, prior to their participation in the operation. In addition, personnel from other provincial ministries, such as Labour and Environment are involved.

Benefits of Prescribed Burning

Slash left from logging operations presents a serious fire hazard for surrounding uncut timber stands. The risk of fire in these areas is heightened where they lie adjacent to roads, portages and waterways frequented by the public. Prescribed burning effectively reduces the fire hazard in cutover areas, leaving them relatively safe from wildfires.

Site preparation for reforestation of a harvested area is costly and difficult if slash is not removed first by burning. Prescribed burning eliminates this problem and reduces vegetation that would otherwise compete with valued desired species. Nutrients from the burnt slash, valuable to young tree growth, are released into the soil.

Forest floors commonly have a thick layer of accumulated organic materials, which must be removed to permit successful seeding to take place. Prescribed burning is a low cost means of preparing the seed site when the moisture level in the organic layer is sufficiently low.



Many wildlife species benefit from disturbances in the forest caused by fire. Moose and deer, for instance require browse not more than nine feet high, while they also require nearby cover from high canopied forests. Prescribed burning can be employed to create and maintain these desirable changes in the environment at certain locations.

Prescribed burning is used as a sanitation tool to destroy infection from residual trees and prevent the buildup of insects which might thrive in logging slash.

Parkland policies may require the perpetuation of existing vegetation. If the vegetation species requires periodic fire to permit regeneration or even propagation, an ecological burn zone map may be prepared to dictate when and where fires should be permitted to take place.

Carrying Out a Prescribed Burn

Ideally, the fire should pass cleanly over the area and consume the undesirable fuels, exposing some but not all the mineral soils. The Canadian Forest Fire Danger Rating System is used in determining weather requirements that must be met before a specific area may be set afire. The amount and type of forest fuels to be burned, and the elements of weather, especially wind and humidity are critical factors. The prescribed burn fire prescription spells out ranges for both for a prescribed burn area.

When all criteria have been met, fire-breaks have been constructed and suppression crews and equipment are in place, ignition is carried out following a planned time, sequence and pattern.

Helicopter mounted aerial ignition devices or hand-held torches are used.

When the specific area has been burned over, suppression crews move in to mop up, as they would in any fire situation. Within weeks regeneration can begin. A new crop of valued, desired trees will be ready for harvest in 70-80 years.

Research and Development - The Future

The research and development branch of the Aviation and Fire Management Centre has the responsibility of surveying new technology that is being produced by the world's research community, and evaluating that which might be useful to the ministry's fire management program.

When evaluations of certain technology are positive, the ministry's research and development team investigates the possible application of the technology to current ministry fire programs and how it might be integrated with existing technology.

The research is not restricted to fire technology. Innovation plays a large part. Infra-red devices had their origin in cancer research. The lightning locator system is a product of the American space program.

Research and development staff also have to identify problems that can't be handled with existing technology. They identify needs and communicate them back to the research community. They are middlemen between the researchers and producers of technology and the ministry's operational people.

The new concept of fire management, as opposed to simple fire control will be greatly enhanced by the application of a large number of computerized decision support systems. One such system currently being developed consists of a network of six minicomputers installed in the five regional fire centres and the provincial fire centre. It is expected to be completely operational by 1987. This system will facilitate the application of the numerous computer based aids developed by forest fire researchers and university staff.

Research and development staff have contributed much to shape the growth and assist the accomplishments of fire management over the years.

Through continued co-operative-research, the future will bring improved developments that can be successfully applied in the fields of analysis, prediction, prevention, detection, control and suppression.

The Challenge

The immediate challenge for the Ontario Ministry of Natural Resources is to reduce the number of fires caused by people – these fires are preventable.

By improving the efficiency of suppression systems and expanding the use of prescribed burning, we can meet a wider range of resource management requirements. The demands of industry and tourism will continue to increase, further enhancing the value of our forests and forest resources.

The responsibility for protecting the forests, forest resources and forest users from wildfire rests with the Aviation and Fire Management organization of the Ministry of Natural Resources.

Ontario fire fighters will continue to accept the challenges of the future, bringing to bear their personal commitment and the most modern methods and technology available.

Glossary of Forest Fire Terms

Aerial Detection - A system for, or the act of discovering, locating and reporting forest fires from detection aircraft.

Aerial Ignition - A technique whereby forest fuels are ignited by dropping ignition agents from aircraft.

Air Attack - A fire control operation involving the use of aircraft to drop water and fire retardant with the objective of suppressing or retarding the spread of forest fires.

Available Fuel - The quantity of forest fuels, from a mineral soil base up to the highest level of the trees that would actually burn under existing conditions.

Backfire - A fire burning or set to burn against the wind.

Back-pack Pump - A portable water container equipped with hand pump and back-pack straps; used mainly in fire fighting.

Base Camp - A strategically located camp through which personnel, equipment and supplies are distributed to line camps.

Bird Dog Aircraft - An aircraft carrying the person in charge of air attack operations over a fire.

Blow-up - Sudden increase in fire intensity or rate of spread, sufficient to upset existing suppression actions or plans.

Burning Out - A fire suppression operation where fire is set along the inside edge of a control line to consume unburned fuel between the line and the fire edge.

Campaign Fire - A fire of such size and/or complexity that it requires a large organization and several days or weeks to suppress.

Canadian Forest Fire Weather Index Tables - Tables of codes and indices for rating fuel moisture content, relative rate of spread and relative fire intensity in a standard fuel complex, thereby providing a uniform assessment of fire weather severity across Canada.

Canadian Forest Fire Danger Rating System - The national system of rating fire danger in Canada, replacing the Canadian Forest Fire Behavior System.

Chicot - A standing, dry, dead tree or part of a dead tree from which at least the smaller branches have fallen.

Closed Area - An area in which specified activities or entry are temporarily restricted to reduce the risk of fires caused by people. In some provinces, a closed area is called a restricted travel zone or a restricted fire zone (Ontario).

Control Line - A comprehensive term for all constructed or natural fire barriers and treated fire edge used to control a fire.

Convection Column - The thermal ascending column of gases, smoke and debris produced by a fire, which is definable in vertical form.

Detection Aircraft - An aircraft used for the purpose of discovering, locating and reporting forest fires.

Duff - A mat of partially decomposed organic matter immediately above the mineral soil, consisting primarily of fallen foliage, herbaceous vegetation and decaying wood.

Fine Fuels - Fuels such as grass, leaves, needles and small twigs, which when dry ignite readily and are consumed rapidly by fire.

Fire Behavior - The manner in which fuel ignites, flames develop and fire spreads and exhibits other phenomena. Common terms used to describe fire behavior include smouldering – making no appreciable spread, and burning without flame; creeping – spreading slowly, usually with low flame; running – a rapidly spreading surface fire; spotting – spreading rapidly with sparks and embers falling outside the fire area and starting spot fires; crowning – a fire ascending into the crowns of trees and/or spreading from crown to crown.

Fire Behavior Index - A numerical rating of expected fire behavior in a specific fuel type, based on meteorological measurements, and topography, which provides either a relative or absolute quantitative measure of one or more fire behavior characteristics, such as rate of spread, fire intensity, flame length and crowning potential.

Fire Boss - The person responsible for all suppression and service activities on a fire.

Line Boss - The person responsible to the fire boss for supervising, directing and inspecting the suppression effort on the entire fire line. May also be known as suppression boss.

Division Boss - A person responsible to the fire boss or line boss (depending upon the degree of organization required), for the conduct of all suppression work on a division. Supervises two or more sector bosses.

Sector Boss - A person responsible to the division boss, line boss or fire boss for the suppression work on one sector of a fire. Supervises two or more crew bosses.

Crew Boss - A person responsible to the sector or fire boss for the supervision of a fire crew on a fire line.

Fire-break - An existing barrier, natural or constructed that will stop or retard the rate of spread of a fire.

Fire Control - All activities concerned with the protection of people, property and forest areas from wildfire; includes prevention, detection, presuppression and suppression.

Fire Control Map - A map used by fire control personnel for locating and plotting forest fires reported, burning and out.

Fire Control Planning - The systematic technological and administrative management process of determining the organization, facilities, resources and procedures required to protect forest areas from fire.

Fire Danger Index - A numerical rating based on one or more fire danger factors, such as fire risk, fuels, weather and topography which is used to judge day-to-day preparedness and suppression requirements, and as a basis for providing information on fire danger to the general public.

Fire Danger Rating - The process of evaluating fire danger by using a system of numerical scales.

Fire Hazard - A fuel complex defined by kind, arrangement, volume, condition and location that forms a special threat of ignition or of suppression difficulty.

Fire Line - The part of a control line that is manually or mechanically prepared for the purpose of controlling a fire, but in a wider sense, the working area around a fire.

Fire Load - The number and magnitude of fires requiring suppression action during a given period within a specified area.

Glossary of Forest Fire Terms

Fire Management - An extension of the concept of fire control, which takes into account resource values, role of fire in the environment, the level of protection required, opportunities for prescribed use of fire, consideration of fire effects and the efficiency of the control operations.

Fire Occurrence - The number of fires started in a given area over a given period of time.

Fire Perimeter - The entire outer edge or boundary of a fire.

Fire Prevention - Activities directed at reducing fire occurrence including public education, law enforcement, personal contact and reduction of fire hazards and risks.

Fire Report - An official report of a fire generally including information on cause, location, action taken, damage and costs from the start of the fire until completion of suppression action.

Fire Retardant - A substance that by chemical or physical action reduces the flammability of combustibles.

Fire Risk - The probability of fire starting, determined by the presence and activities of causative agents.

Fire Season - (Ontario – April 1 to October 31 annually). The period or periods of the year during which fires are likely to occur, spread and do sufficient damage to warrant organized fire control; a period of the year set out and commonly referred to in fire control legislation.

Fire Triangle - The three elements necessary to any fire – fuel, heat and air (oxygen).

Fire Weather Index (FWI) - A numerical rating, based on meteorological measurements of fire intensity in a standard fuel type. The FWI is comprised of three fuel moisture codes covering classes of forest fuels of different drying rates, and two indices that represent rate of spread and the amount of fuel available, which collectively provide a uniform scale for rating fire weather severity.

Flammability - The relative ease with which a substance ignites and sustains combustion.

Forest Fire - Any fire which is burning forest vegetation and which is not being used as a tool in forest protection or management in accordance with an authorized plan. Types of forest fires include ground fire – a fire that burns in the organic material under the surface; surface fire – a fire burning primarily the litter on the forest floor, together with young trees and shrubs, and spreading through these surface fuels rather than crowning; crown fire – a fire that advances through the tops of trees, more or less in conjunction with the surface fire.

Fuel Moisture Content - The quantity of moisture in fuel expressed as a percentage of the oven-dry weight of the fuel.

Fuel Type - An identifiable association of fuel elements of distinctive species, form, size, arrangement or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified burning conditions.

Hazard Reduction - A treatment of fuels to diminish the chance of fire starting or spreading in them.

Heavy Fuels - Fuels of large diameter or of a peaty nature which are difficult to ignite and burn slowly compared to fine fuels.

Helitack - Initial attack on forest fires involving the use of helicopters and trained firefighters.

Hot Spot - A particularly active part of a fire or a small area still burning or smouldering after the main fire has been extinguished.

Hot Spotting - Checking the spread of a fire at points of more rapid spread or special threat, as opposed to working all parts at the same time or progressively.

Ignition Pattern - The manner in which a prescribed burn is set, determined by weather, fuels, topography and other factors having influence on the fire and the objective of the fire.

Initial Attack - The action taken to control a fire by the first fire fighting force to arrive at a fire.

Line Camp or Fire Line Camp - A camp with minimum facilities established along a fire line or near a forest fire to accommodate and supply personnel engaged in fire suppression or mop up work; does not include base camp.

Litter - The uppermost layer of organic debris composed of freshly fallen or slightly decomposed organic materials.

Mineral Soil - The inorganic, unburnable soil beneath the duff layer i.e. sand or gravel.

Mop Up - The act of making a fire area safe after the fire has been brought under control. This includes extinguishing all traces of fire above and below the surface.

Overstory - Large trees, especially the towering canopy formed by branches, needles and leaves.

Prescribed Burning - The supervised burning of forest fuels on a specific area under predetermined conditions, so that the fire is confined to that area to fulfill silvicultural, wildlife management, sanitary or hazard reduction requirements.

Presuppression - Those fire control activities in advance of fire occurrence, concerned with the organization, training and management of a fire control force and the procuring, maintenance and inspection of improvements, equipment and supplies to ensure effective fire suppression.

Pulaski - A combination chopping and trenching tool which combines a single-bitted axe-blade with a narrow adze-like trenching blade fitted to a straight handle.

Rate of Spread - The rate of which a fire extends its horizontal dimensions. It is expressed as rate of increase of the fire perimeter, as rate of increase in area, or as rate of advance of the fire head, depending on the intended use of the information.

Slash - Debris left on the ground after logging, pruning, thinning or brush cutting; it includes logs, chips, bark, branches, stumps and broken understory (small trees or brush).

Strategy, Fire Suppression - Determining where and how to fight a fire, having regard to staffing and servicing the control organization, in relation to the behavior of the fire as a whole. It presupposes a certain choice of tactics but leaves the final determination of their application to decisions on the ground.

Stumpage - A fee paid to a landowner by a woodcutter or company for trees cut on the landowner's property.

Understory - Small trees and brush.

Water Bombing - The act of dropping water or short term retardant on a forest fire from an aircraft in flight.

Wetting Agent - A chemical added to water that reduces the surface tension of the water and causes it to spread and penetrate the ground more effectively.

Wildfire - An unplanned fire, as contrasted with a prescribed burn. May be a forest fire or it may be burning in grass, brush or tundra.

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